Applied Electricity.

A Dictionary of Applied Physics. Edited by Sir Richard Glazebrook. Vol. II. *Electricity.* Pp. vii + 1104. (London: Macmillan and Co., Ltd., 1922.) 63*s.* net.

IT is interesting to compare the second volume of Sir Richard Glazebrook's "Dictionary of Applied Physics" with the electrical portions of older dictionaries. For example, in Barlow's "Dictionary of Pure and Applied Mathematics" (1814) it is said that "the science of electricity became a general subject of conversation" after the discovery of the "Leyden Vial." In Nichol's "Cyclopædia of the Physical Sciences" (1860) we learn that electrical science "has spoken for itself to the world as no other has." "Witness the simultaneous discovery of the Leyden Phial and the Electric shock." Three practical applications of electricity are given, namely, the lightning-conductor, the electric telegraph, and electroplating. The last is specially commended as being "so conducive to the comforts and elegancies of life." An examination of the volume under review will show how greatly our knowledge has been widened during the last sixty years. We were sorry, however, not to have seen the "Leyden Jar" mentioned.

The plan of the dictionary follows to a certain extent that adopted by Nichol, but the important sections are much larger. In fact, quite substantial books could be made of the sections written by some of the contributors. Besides the important contributions there are a few short articles and many definitions of electrical quantities, machines, instruments, and methods. The absence of an index makes it difficult to find out whether any subjects have been omitted or not. There is a very elaborate name-index, but this will be little help even to the older physicist or electrician, as many of the names will be unknown to him. We think that the younger physicist will have considerable difficulty in finding out what he wants. Doubtless, this will be remedied when the final volume is published. We have not noticed anything about electric traction, electric ship-propulsion, electric vehicles, lightning-conductors, rotary and frequency converters, electrostatic machines, the attraction between electrified spheres, or the fixation of nitrogen. We take it that atmospheric electricity will come under meteorology in the next volume.

We were glad to notice that the contributors had not been handicapped by being compelled to adopt a rigid nomenclature and an invariable set of symbols. As a rule, those agreed on internationally have been adopted. Although considerable use has been made throughout of elementary vector analysis, there is little demand made on the reader's knowledge of mathematics. Academical subjects, like spherical harmonics and the perennial "electrified ellipsoid," have been omitted.

Dr. Rayner has written a useful section on alternating-current instruments and measurements. He has made a happy selection of the best modern measuring instruments. His description of the electrostatic watt-meter is specially good. Occasionally his straining after conciseness leads him into inaccuracy; as when he says (p. 11) that the torque is equal to the square of the volts instead of being merely proportional to that quantity. There is a misprint also in the equation on this page. The articles on primary batteries, accumulators, and cables are good, but the last could have been expanded with advantage. The assumption on p. 94 that the thermal emissivity is independent of the radius of the wire is certainly not true, and we doubt whether the formulæ given on p. 95 are of general application.

Mr. Albert Campbell contributes a valuable article on electrical capacity and its measurement. He generally refers to capacity as "capacitance," which is the name the Americans now use, and he calls the capacity between two conductors the "working capacity." He clearly recognises the difference between two of the various kinds of capacity and calls them by different names. In other parts of the volume, however, which capacity is meant is not so clear. For example, under units (p. 948), we read that a conductor which had a capacity of 1 farad "even though composed of plates very close together, would be very large." It looks as if conductor were a misprint for condenser. The various kinds of capacities have been clearly defined by nomenclature committees of the Physical Society and of the Institution of Electrical Engineers. On p. 107 formulæ for the capacity between two circular plates and the capacity to earth of one of them are given; the formulæ are only approximations and no limitations to their accuracy are given. Their value is therefore doubtful. We note misprints in formulæ (27), (50), (54), and (55).

T. Gray's results for the dielectric strengths (now usually called the electric strengths) of air at different thicknesses are given. We think that this is a misleading way of interpreting the experimental results. If we consider spherical electrodes in air, the disruptive voltages are computed in everyday work from their distance apart and their radii, with a maximum inaccuracy of about 1 per cent. From these experiments we would conclude that the assumption that the electric strength of air was 27·4 kilovolts per cm. at 25° C. and 76 cm. pressure, whatever the thickness of the layer might be, would lead to very approxi-

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mately correct results in nearly every case. We notice that the author adopts Kennelly's names for the absolute unit of electric quantity, capacity, and pressure. We thus get the abcoulomb, the abfarad and abstatfarad, and the abvolt. As they have never been recognised, even in America, by any technical society or institution, they are "technically irregular." It has to be remembered, however, that all good new names are introduced in this way.

We do not like the phrase "dielectric constant"; it surprises, at least mathematicians, to find that this "constant" varies with temperature. Many excellent methods of measuring capacity are given, but beginners would appreciate some little guidance as to which one to adopt in special cases.

Dr. Rayner's article on dielectrics will be appreciated by engineers, and Mr. Melsom's article on direct-current indicating instruments will be most helpful in the test-room of every factory. Mr. F. E. Smith writes an authoritative article on systems of electrical measurements which will be of great value for reference by subsequent writers. Dr. Allmand gives a concise and excellent description of the technical applications of electrolysis. Any one reading the fascinating account of the electron theory and its application to spectrum analysis, by Sir William Bragg, will find it difficult to believe that Rutherford and Bohr's theories of the atom are not substantially correct. In his description of "electrons and the discharge tube" Dr. Crowther is also very convincing.

Mr. F. E. Smith gives an illuminating account of galvanometers, including very helpful rules for choosing a galvanometer for a particular purpose. Mr. Butterworth writes a valuable account of the formulæ used for measuring inductance and gives an excellent table for computing the mutual inductance between coaxial circles. We miss, however, his own formula and that of Mr. H. L. Curtis for computing the high-frequency inductance of parallel cylindrical wires. Mr. Campbell gives a very complete account of methods of measuring inductance and gives some 200 references to papers on the subject. The method of compensating for the inductance of a coil shown on p. 402 is not as accurate as the author states, a term having been left out in the algebraical reduction shown on this page. Mr. Dye, in "Magnetic Measurements and Properties of Materials," has produced a very complete account of modern methods.

The General Electric Company gives a very brief account of "incandescence" lamps, which is excellent so far as it goes. Most readers would like to have had further data on tungsten vacuum and gas-filled lamps. The Americans are not so reticent. We note that the temperature of the tungsten filament is about "2300° K." We take it that this is in the absolute Centigrade scale and that the K. refers to Kelvin. This is "technically irregular"; but there is a real demand by engineers and by some physicists that the absolute Centigrade scale, which is the one they use, be called the Kelvin scale, and we hope that this nomenclature will be adopted.

Prof. Honda gives a thoughtful article on the molecular theories of magnetism, and we have an account of Ewing's latest model. Dr. Chree writes a thorough and interesting account of the observational methods used in terrestrial magnetism, and Dr. Chapman describes some of the theories of terrestrial magnetism and how far the solar agent is responsible for magnetic storms and auroræ. Positive rays are described by Dr. Aston. A description is given of his mass-spectrograph and typical mass spectra are shown.

The lengthy article on radio-frequency measurements by Mr. Dye will be appreciated by workers in many research laboratories, as these methods are often of great value. We are doubtful whether it is legitimate to assume that the capacity of a coil can be represented by supposing that the coil has no capacity and that a condenser of a certain size is placed across its terminals. The formula for the high-frequency resistance of a round wire at an infinite distance away from other wires is given, but the formulæ found recently for more practical cases are not given.

Very complete accounts are given of switch-gear, telegraphy, and telephony, which will be appreciated by electrical engineers. We have only space to mention the valuable articles on vibration galvanometers, wireless telegraphy, and thermionic values, by Mr. Campbell, Dr. Eccles, and Prof. Fortescue. Finally, the articles by Prof. Richardson and Dr. Wilson on thermionics, Mr. Smith-Rose on the use of thermionic valves, Mr. Melsom on direct-current meters, and Dr. Crowther on X-rays, are of great value.

Under units it is stated that, at the International Electrical Conference held in Paris in 1900, the Gauss was defined to be the C.G.S. unit of magnetic force, and the Maxwell was defined as the practical unit of magnetic induction. It is also stated that if we take the permeability of air to be unity and to be a pure number, the value of the Maxwell is the same as that of the Gauss. But the Maxwell is not the unit of magnetic induction density. Hence we should read in this case that a Maxwell per square centimetre is the same as the Gauss. There are several definitions of self-inductance given: that appearing on p. 727 is wrong, as the self-inductance is the linkage of the magnetic induction, and not the magnetic force, with the current. In no case is it explained how the linkages inside the conductor have to be computed. We have

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noticed a few other slips and misprints. They do not appreciably detract, however, from the value of this volume, which will be welcomed by all physicists and engineers.

Spitsbergen and its Wild Life.

Amid Snowy Wastes: Wild Life on the Spitsbergen Archipelago. By Seton Gordon. Pp. xiv + 206, 2 maps and 114 illustrations. (London: Cassell and Co., Ltd., 1922.) 15*s*. net.

ALTHOUGH the Spitsbergen Archipelago is only six hundred miles from the north pole, yet, owing to its accessibility, due to the influence of the Gulf Stream drift which reaches its western shores, it has been much visited in the summer months by naturalists and sportsmen, with the result its bird-life is better known than that of a number of continental countries. Its ornithology is encrusted in a remarkable literature dating from 1598, which comprises no less than 150 contributions, and includes Prof. Koenig's "Avifauna Spitzbergensis," which from the beauty of its meisenbach pictures of scenery, and its excellent coloured plates of birds and their eggs, is entitled to rank among the most attractive of bird-books, while its letterpress exhausts the historical aspect of the subject down to the year of its publication, 1911.

The latest expedition was organised by the University of Oxford, and visited the archipelago in the summer of 1921 under the leadership of the Rev. F. C. R. Jourdain. Mr. Gordon accompanied the party in the capacity of photographer, and hence the main attractions of his book lie in the wealth and nature of its illustrations, about one hundred in number. These are supplemented by a series of pleasantly written chapters wherein he relates his personal observations and experiences. The scientific results of the expedition, however, will appear in due course; those relating to ornithology are being prepared by Mr. Jourdain, who is an eminent authority on the subject.

The most interesting pictures and chapters of Mr. Gordon's book are devoted to the pink-footed goose, Brent goose, long-tailed duck, purple sandpiper, grey phalarope, glaucous gull, and various nesting colonies. The chief captures made by the expedition were a number of eggs of the Bernicle goose, concerning the nesting habits of which no trustworthy information was forthcoming until 1907, when the first eggs were found at Spitsbergen by Prof. Koenig. Five nests and twenty eggs were obtained in 1921, but for some unexplained reason the nest of this bird—not yet depicted—does not appear in Mr. Gordon's series, though a chapter is devoted to it.

An interesting account is given of the coal-mining

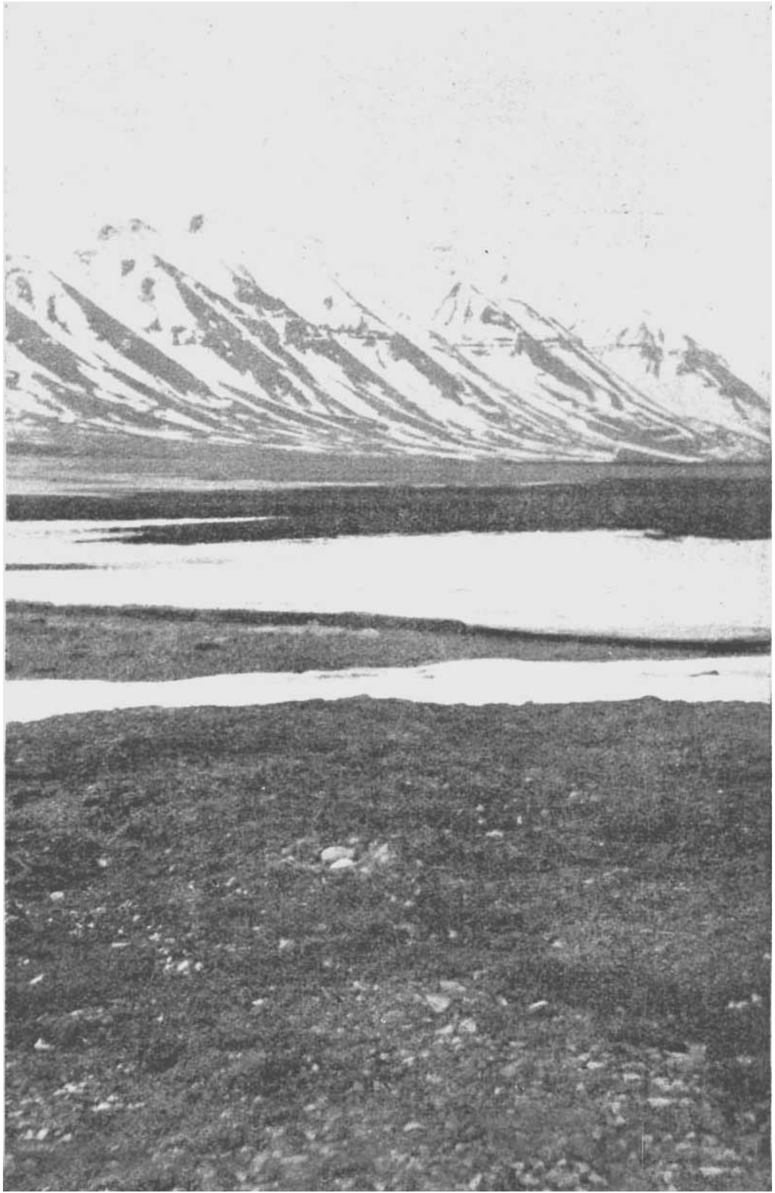

FIG. 1.—Nesting ground of the Pink-footed Goose. From "Amid Snowy Wastes."